Vector Addition of Forces

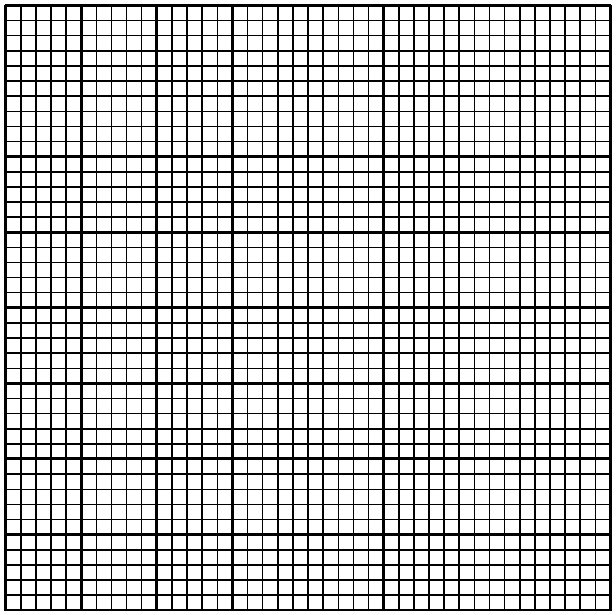
Name: _____ Section: 2AL-___ Date performed: __/__/__

Lab station: ____ Partners: _____

Finding the resultant of two forces

$\vec{A} = 250\,\text{gwt} \text{ @ } 30^\circ \qquad \vec{B} = 500\,\text{gwt} \text{ @ } 135^\circ$

(Q-1) Find the resultant graphically.



Scale: 1 cm = _____ gwt

$\vec{R}_{\text{graph}} =$ _____ @ _____

(Don't forget to include units.)

(Q-2) Find the resultant analytically.

Force	x-component (gwt)	y-component (gwt)
$\vec{A}$		
$\vec{B}$		
$\vec{R}$		

$$\vec{R}_{\text{anal}} = \_\_\_\_\_ \text{ @ } \_\_\_\_\_$$

How do $\vec{R}_{\text{graph}}$ and $\vec{R}_{\text{anal}}$ compare? Are they close? If not, go back and find your mistake and correct it.

(Q-3) Find the resultant experimentally.

Set up the forces $\vec{A}$ and $\vec{B}$ on the force table and determine the equilibrant.

$$\vec{E} = \_\_\_\_\_ \text{ @ } \_\_\_\_\_$$

$$\vec{R}_{\text{exp}} = \_\_\_\_\_ \text{ @ } \_\_\_\_\_$$

How are $\vec{R}_{\text{exp}}$ and $\vec{E}$ related?

Finding the weight of a rock with the force table

(Q-4) Balance the rock with 3 known forces of unequal magnitude.

Direction of rock force = _____

	Magnitude (gwt)	Direction (deg)	x (gwt)	y (gwt)
$\vec{F}_1$				
$\vec{F}_2$				
$\vec{F}_3$				
$\vec{R} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$	XXXXX	XXXXX		

$\vec{R}$ = _____ @ _____

Is the direction of $\vec{R}$ consistent with the direction of the rock force on the force table? Explain.

(Q-5) Calculate the weight of the rock.

When hanging the rock on the force table, did you connect it to something else with a substantial mass (such as a 50 g hanger)? If so, what was it and how much did it weigh?

Taking the added weight (if any) into account, calculate the weight of the rock alone.

W_{exp} = _____

(Q-6) Weigh the rock with an electronic balance.

W_{meas} = _____

(Q-7) Compare W_{exp} and W_{meas}.

$$\text{Percent discrepancy} = \frac{|W_{\text{exp}} - W_{\text{meas}}|}{W_{\text{meas}}} \times 100\% = \_\_\_\_\_$$

Exercises

1 gwt converted to SI units is equal to

(A) 1 g
(B) 9.8 g
(C) 1 N
(D) 9.8 N
(E) 0.0098 N

If $\vec{A} = 350\,\text{gwt} \mathbin{@} 50°$, then $-\vec{A}$ is equal to

(A) $350\,\text{gwt} \mathbin{@} -50°$
(B) $350\,\text{gwt} \mathbin{@} 230°$
(C) $-350\,\text{gwt} \mathbin{@} 50°$
(D) $-350\,\text{gwt} \mathbin{@} -50°$
(E) $-350\,\text{gwt} \mathbin{@} 230°$

A certain vector has an x-component of -3 and a y-component of $+4$. You calculator says $\arctan(4/-3) = -53°$. The direction of the vector is

(A) $-53°$
(B) $53°$
(C) $-127°$
(D) $127°$
(E) None of the above.

Explain:

What is the "resultant" of a group of vectors?

(A) the vector sum.
(B) the sum of the magnitudes.
(C) negative of the vector sum.
(D) negative of the sum of the magnitudes.

What is the "equilibrant" of a group of vectors?

(A) the vector sum.
(B) the sum of the magnitudes.
(C) negative of the vector sum.
(D) negative of the sum of the magnitudes.

Why is it important that the ring be centered around the pin when multiple weights are balanced on the force table?

(A) If the ring is not centered, the system cannot be in equilibrium.
(B) If the ring is not centered, it will be impossible to stabilize the system.
(C) If the ring is not centered, the system still may be in equilibrium, but the angles that you read will be incorrect.